The Effect of Co-Firing Biomass and Coal on the Performance of SCRs

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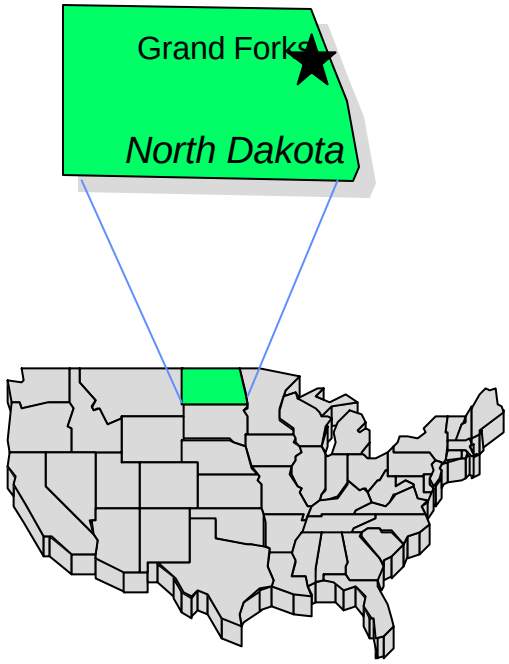
October 25, 2002

Energy & Environmental Research Center

Center for Biomass Utilization
Grand Forks, North Dakota



EERC Center for Biomass Utilization

- Encompasses over $4 million of activities at the EERC
- Biomass-coal cofiring and impacts on emissions and operation
- Biomass gasification for energy and products
- Utilization of biomass in district energy sources
- Conversion of biomass to “green” chemicals
- Ethanol production and environmental end-points
- Biomass-derived fly ash utilization.

Research Directions in Biomass Utilization

- Thermal and fast pyrolysis pretreatment of biomass for ethanol
- Fermentation biorefinery methods for high-value chemicals
- Hydrogen production from biomass
- Gasification for syngas
  - Conversion of product gas and char to energy in gas turbines, reciprocal engines, and steam boilers
  - Conversion of product gas to ethanol and high-value chemicals
  - Increased efficiency and easier capture of CO_2
  - Hydrogen for fuel cells
- Integrated systems: ethanol or biodiesel production, district energy, products and energy, and colocation

Types of Biomass

- Wastes and residues
  - Wood: forest or tree trimmings, sawdust, demolition wood, crates, railroad ties
  - Agricultural residues: wheat straw, rice straw, potato and beet residue, bagasse, and corn stover
  - Animal wastes: litter and manure
  - MSW
- Agricultural energy crops: switchgrass, hybrid poplar and willows, bamboo, and elephant grass




Benefits and Importance of Biomass Utilization

- Renewable and alternative
- Decreases greenhouse gas accumulation
- Increases national security and decreases world tensions
- Reduces wastes: landfill space, terrestrial pollution, and reduced methane from decay
- Economic impacts on agricultural, energy, and other industrial economies
- Environmental impacts: air toxic emissions, biodegradable products

Background

- Biomass and low-rank coals often contain larger relative quantities of alkali and alkaline-earth elements (i.e., potassium, sodium, calcium, and phosphorus) in addition to moderate sulfur levels.
- These constituents have the potential to impair the operation of SCR systems by the formation of sulfate- or phosphate-based deposits on catalyst surfaces, leading to higher NOx emissions and potentially high ammonia slip.
- Biomass can also contain elements such as arsenic which can poison catalysts

SCR Biomass Project Objectives

- Determine potential for blinding of selective catalytic reduction (SCR) catalysts for biomass-coal cofiring
- Determine mechanisms of SCR blinding specific to biomass components

Issues Involving Biomass and SCR

- Potassium: chlorides, sulfates, and perhaps phosphates
- Calcium: similar to low rank PRB with potential sulfates and phosphates
- Organically dispersed K and Ca and very fine silica coupled with alkali and sulfur in coals may create a significant flux of fine particulate in SCR
- Coal mineral components may interact with and immobilize some of the volatile potassium.

Project Work Plan

- Selection of utility boilers for testing
- Biomass resource acquisition and characterization
- Bench-scale biomass SCR blinding under separate DOE project
- Four to six months of testing for SCR blinding in two full-scale utility boiler units
  - Skid-mounted test rigs
  - Two different boilers burning different coals and different biomass types
- Determine root causes and mitigation measures for blinding deposits

Estimated Project Cost

- Multiclient consortium with U.S. DOE joint venture funding leverages funds (lots of research for a small investment of a participating sponsor)
- $270,000 Industry ($60,000 per industry sponsor)
- $180,000 U.S. DOE
- Total Project Budget $450,000

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Project Just Getting Underway!
Still Time to Join!

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